



311020

16-22-07

# ILLINOIS ENVIRONMENTAL PROTECTION AGENCY WATER POLLUTION CONTROL PERMIT

PERMIT NUMBER: 1976-EA-273-OP

DATE ISSUED: March 10, 1976

PROJECT LOG NUMBERS: 114-76

SUBJECT: U.S. INDUSTRIAL CHEMICAL COMPANY - Industrial Waste Disposal Well  
(Douglas County) Tuscola, Illinois

U.S. Industrial Chemical Company  
P.O. Box 218  
Tuscola, Illinois 61953

Permit is hereby granted to U.S. Industrial Chemical Company, Tuscola, Illinois, to operate existing water pollution control facilities for the deep well injection of waste produced at the plant site. This Permit is based on documents received by this Agency on February 10, 1976, and on previously submitted documents which described the deep well system prior to and after completion.

This Permit renews and replaces Permit #1975-EA-242-OP dated May 14, 1971.

This Operating Permit expires May 14, 1977.

This Permit is issued for the injection of waste at a maximum rate of 400 gpm and at a maximum injection pressure of 250 psig.

## READ ALL CONDITIONS CAREFULLY: STANDARD CONDITIONS

(Permit continued on attached pages)

1. If any statement or representation is found to be incorrect, this permit may be revoked and the permittee thereupon waives all rights thereunder.

2. During or after the construction or the installation of the facilities covered by this permit any agent duly authorized by the Illinois Environmental Protection Agency shall have the right to inspect such facilities and its operation.

3. The issuance of this permit (a) shall not be considered as in any manner affecting the title of the premises upon which the permitted facilities are to be located; (b) does not release the permittee from any liability for damage to person or property caused by or resulting from the installation, maintenance or operation of the proposed facilities; (c) does not take into consideration the structural stability of any units or parts of the project; and (d) does not release the permittee from compliance with other applicable statutes of the State of Illinois, or with applicable local laws, regulations or ordinances.

4. Treatment works will be operated or supervised by a duly qualified treatment works operator certified under the Regulations of the Illinois Environmental Protection Agency.

5. The facilities covered by this permit shall be constructed and operated in compliance with the provision of the Illinois Environmental Protection Act and Chapter 3 of the Rules and Regulations as adopted by the Illinois Pollution Control Board.

This permit is issued in accordance with the Illinois Environmental Protection Act of 1970 and the Chapter III Water Pollution Regulations adopted pursuant thereto by the Illinois Pollution Control Board.

6. Plans, specifications and other documentation submitted shall constitute a part of the application and when approved shall constitute part of this permit.

7. This Permit may not be assigned or transferred without a new permit from the Illinois Environmental Protection Agency.

8. There shall be no deviations from the approved plans and specifications unless revised plans, specifications and application shall first have been submitted to the Illinois Environmental Protection Agency and a supplemental permit issued.

9. The installation shall be made under the supervision of an inspector, who is familiar with the approved plans and specifications provided by and approved by the owner, and said inspector shall require that construction complies with the plans and specifications approved by this Agency.

10. Unless otherwise stated by Special Condition, construction must be completed in three years for treatment works and two years for sewers and wastewater sources.

11. Discharges into the sanitary sewer(s) constructed under this permit shall consist of wastewater only. Storm waters shall not be permitted to enter the sanitary sewer(s). Roof and footing drains shall not be connected to the sanitary sewer(s) constructed under this permit.

WHB:JRL:11

cc: Region III-C

Ill. State Water Survey

Ill. State Geological Survey

Dept. of Mines &amp; Minerals

Executive Director, ORSANCO

WPC-146

DIVISION OF WATER POLLUTION CONTROL

William H. Busch,

Manager, Permit Section

The wastes to be injected consist of:

1. rainfall leachate from 80 acres of waste gypsum
2. ion exchange resin regeneration waste
3. cooling tower and boiler blowdown water
4. plant wastes containing water soluble organic material
5. laboratory wastes, including mercury compounds

The main characteristics of the wastes are: low pH, high total dissolved solids, mercury, fluoride, organic carbon, sulfate, chrome and BOD.

The injection wastes should be sampled daily (if waste is injected) at the wellhead and a weekly composite sample made and analyzed for pH, total dissolved solids, total organic carbon, phosphorus, sulfate, fluoride, chloride, calcium, magnesium, chromium and suspended solids. Each calendar quarter, one weekly composite will be analyzed for potassium, mercury and sodium.

Monthly operating reports must be submitted in one copy each to the following four addresses:

1. Illinois Environmental Protection Agency  
Division of Water Pollution Control  
Permit Section  
2200 Churchill Road  
Springfield, Illinois 62706
2. Illinois Environmental Protection Agency  
Division of Water Pollution Control  
Field Operations Section - Region III-C  
Champaign, Illinois
3. Illinois State Water Survey  
Post Office Box 232  
Urbana, Illinois 61801
4. Illinois State Geological Survey  
Natural Resources Building  
University of Illinois  
Urbana, Illinois 61801

The transmittal letter should show that the above addresses were sent a copy of the report.

The operational reports shall contain as a minimum the following:

1. the total number of hours of injection during each day.
2. the total number of gallons of waste injected each day.
3. the total number of gallons of waste injected during the month and the total number of gallons of waste injected since the well began operation.
4. the maximum injection pressure for each day.
5. the maximum injection rate for each day.
6. the maximum and minimum annulus pressure for each day.
7. analyses from the weekly sampling of the injection waste.
8. at least monthly, the viscosity and specific gravity should be measured; the temperature of the sample at the time of collection and the temperature of the sample at the time of measurement both should be recorded and reported.
9. a summary of any operational difficulties encountered, including reasons for any alarms and a description of any changes in the operation of the deep well systems or wastes injected; if any maintenance is performed during the month, a detailed report shall be submitted, including a written daily description of activities during the rework period, copies of logs run, and a revised well drawing showing casing, injection tubing and downhole appurtenances (showing material description, specifications and model designation, manufacturer, etc.), names and addresses of service companies performing the service function, and Company's consultant name supervising the repair work.
10. Once per quarter, a representative set of well operation charts for a one week period shall be submitted along with the monthly report.

A permanent record should be kept of all recording charts for the deep well instruments. These records shall be open to reasonable inspection by appropriate State Agencies.

The Permit Section and the Field Operations Section (Champaign Office) of the Division of Water Pollution Control shall be notified immediately if any situation occurs which could result in pollution of the waters of the State.

Standard Conditions of issuance of this Permit are itemized on Page 1.

SPECIAL CONDITION #1:

Should changing injection conditions so warrant during the term of this permit, the Agency may require modifications to the deep well injection facilities including surface works and down hole facilities, to insure the integrity of the system and to insure adequate protection to the waters of the State (both surface and subsurface). In addition, the Agency may require that injection of wastes cease either temporarily or permanently and that if necessary to abandon the well, that it be properly plugged in accordance with procedures acceptable to the Agency, and the Illinois Department of Mines and Minerals.

ATTACHMENT 1  
SUPPLEMENTAL INFORMATION  
DEEP WELL OPERATING PERMIT APPLICATION  
U. S. INDUSTRIAL CHEMICALS CO.  
TUSCOLA, ILLINOIS

2598-73

RECEIVED

JUN 27 1973

1. Exact location of well

ENVIRONMENTAL PROTECTION AGENCY  
STATE OF ILLINOIS

430 ft. south and 1135 ft. east of the Northwest  
Corner of Section 31, Township 16 N, Range 8 E,  
Douglas County, Illinois.

Do  
Tuscola Twp  
USI OWNER

2. A sketch and description of surface facilities  
connected with the disposal well

1/2 mile N of  
36

U. S. Industrial Chemicals Company, DWG. No. 25P-5757-1  
(Attachment 5) shows the surface facilities connected  
with the disposal well. A low-pressure high-volume  
centrifugal pump was installed in the system to boost  
the flow to the well and was reported with performance  
curves on June 1, 1971.

3. Description of general operating procedure for disposal  
well, including emergency shutdown procedure

Attachment 2 is a copy of "Disposal Well Procedures"  
prepared by Engineer C. H. Hesser, July 12, 1971. It  
fully describes the procedures to be taken during  
operation and in an emergency shutdown of the well.

4. The drainage pattern starting with the stream to which  
you would discharge if the discharge was a surface  
discharge instead of a deep well injection and ending  
at the Mississippi River

The Kaskaskia River is the receiving stream for all  
surface wastes from this plant. The Kaskaskia River  
flow is impounded at Shelbyville and Carlyle before  
final discharge into the Mississippi River south of  
St. Louis.

5. All previous permits issued by this agency or its predecessor for construction or operation of this deep well

Operating Permit No. 1970-EA-517 issued in letter form from EPA to U. S. Industrial Chemicals Company, August 4, 1970.

Construction permit issued in the form of a letter from the Sanitary Water Board to U. S. Industrial Chemicals Company, February 9, 1970.

6. Total depth of well

Total well depth is 5524 ft. measured from the rotary bushing which is 708 ft. above sea level.

7. Date well began injection

Injection began on September 1, 1970.

8. Lowest depth of cemented (a) double casing (b) single casing

Lowest depth of cemented casing is (a) 2810 ft. for double casing; (b) single casing 5015 ft.

9. Injection formation name and depth (top)

Injection formation is Eminence-Potosi dolomite. The top of the structure is 5075 ft.

10. Type of injection tubing

Injection tubing is 4" carbon steel pipe lined with Rice Engineering's PVC liner (Duoline liner).

11. Description of annulus protection system (annulus between casing and injection tubing)

The annulus protection system is described in attached reports as follows:

- (a) Plans, Procedures and Specifications, January 2, 1969, (correct year should be 1970) by C. H. Hesser, pages 5 and 6, (handcarried to Sanitary Water Board in Springfield on January 7, 1970). Attachment 3.

(b) Disposal Well History, May 27, 1970, by C. H. Hesser, page 6, (mailed to Sanitary Water Board same date). Attachment 4.

(c) Disposal Well Procedures, July 12, 1971, by C. H. Hesser. (See Attachment 2 for item 3 above).

12. Maximum injection rate and maximum injection pressure

Maximum injection rate achieved is 542,000 gpd; maximum injection pressure has been 30 psig at the wellhead.

13. General description of source and type of wastes

Wastes to be stored via subsurface emplacement are as follows:

- Rainfall accumulation on approximately 80 acres of by-product gypsum (accumulated over a 14-year period of operation of a wet process phosphoric acid plant; operation was discontinued in August 1971). Leachate contains primarily calcium, magnesium, phosphate, sulfate, potassium sodium ions, and free phosphoric, sulfuric, and hydrofluoric acids.
- Ion exchange resin regeneration waste, containing primarily calcium, magnesium, sodium, phosphate and sulfate ions.
- Cooling tower and boiler blowdown water containing primarily calcium, magnesium, sulfate, chloride, and chromate ions.
- Occasional accumulations of water containing water soluble organic material, primarily ethyl alcohol.
- Sample residues from the quality control laboratory containing organics, primarily ethyl alcohol and diethyl ether, and mercury compounds.

14. List of chemical constituents in fluid to be injected, including all parameters necessary to characterize the waste

Comp. range of the injected fluid is as follows:

Density, g./ml. @ 25°C	1.00-1.03
pH	1-2
Total dissolved solids, wt. %	2-4
Total organic carbon, mg./l.	200-1500
Sodium, wt. %	0.1-0.2
Phosphorous as P <sub>2</sub> O <sub>5</sub> , wt. %	0.2-0.6
Sulfur as SO <sub>4</sub> <sup>=</sup> , wt. %	0.2-1.0
Fluoride as F <sup>-</sup> , ppm	1000-7000
Chloride as Cl <sup>-</sup> , ppm	10-100
Mercury as Hg, ppB	0.1 to 10
Potassium as K <sup>+</sup> , ppm	100-400
Calcium as Ca <sup>++</sup> , wt. %	0.2-0.4
Magnesium as Mg <sup>++</sup> , wt. %	0.05-0.1
Cr <sup>+</sup> <sub>6</sub> , ppm	0-4
BOD <sub>5</sub> , mg./l.	300-2200
Suspended solids, mg./l.	10-80

15. Total amount of fluid injected into well since well began operation

Total quantity of waste water injected into the well at the end of April 1973 was 310,369,000 gallons.

16. Any other information which is needed to adequately describe the operation

The information which is included in these statements and with the construction and operating permit applications adequately describes the operation.

17. Outline a brief history of repair, workover activity and logging operations performed on the well to date. Please comment on the reasons for these activities

This well has excellent flow characteristics and very few maintenance and operational problems. The originally installed 2-1/2" plastic-coated tubing system would not handle the required volume; on July 13, 1970, we confirmed in writing our request to change from a 2-1/2" to a 4" tube.

The well was put in service on September 1, 1970. Since the packer was not seating properly and permitted the pressure to be released on the annulus, the operation stopped on October 24, 1970. When the tubing string was pulled to remove the packer, severe corrosion was found on a few of the tubing couplings. After this find, it was decided to leave the well down for a complete review of all known facts.

On March 16, 1971, the well was put back in service with an Otis packer and a 4" tubing string with a PVC lining instead of the original plastic coating. These changes were confirmed in writing to the Surveillance Section of the EPA on June 1, 1971.

Since that time, the well has been trouble free except for minor repairs on the surface equipment.

ATTACHMENT 2

July 12, 1971

To: See Distribution

From: C. H. Hesser

Subj: DISPOSAL WELL PROCEDURES

E-TX-458

If, for any reason, the injection into the Disposal Well is interrupted or ceased, the vacuum breaker will preclude forces to rupture the plastic lining in the tubing. Since the vacuum breaker is below the master valve on the Xmas tree, it should operate whether the master valve is closed, the pump stops from lack of electricity, or suction is plugged or lost.

The injected water is cooler than the average temperature of the water in the annulus (between the tubing and casing) so when injection stops, the temperature and resultant casing pressure rises. Therefore, it (the casing) should be bled off to prevent its rising until it activates the safety valve. Pressure release of the safety valve could cause an unsightly mess in the building around the well, but no catastrophic consequences.

It is recommended (and has been our past policy) to flush the well with fresh water when it was shut in for any reason which required more than a few hours. This may not be absolutely necessary, but the water is connected and can be done easily to provide a small safety practice. Two hours of flushing should do the job.

After being shut in, when injection is resumed, the cooler water injected will cool off the annulus, so if the water supply valve is not open to the casing, it should be opened and the casing pressure raised up to about 50 psi. There is nothing magic about 50 psi, but a casing pressure higher than the tubing pressure is desired, but not so high that the night-to-day temperature changes will raise the casing pressure to the pressure release point of the safety valve. The water supply line has a check valve so it can feed water to the casing, but will not accept back flow when the casing pressure exceeds the water supply pressure.

To: See Distribution  
Subj: DISPOSAL WELL PROCEDURES

July 12, 1971  
Page 2

Occasionally, the firewater system is tested and pressure increases to 90 to 100 psi. When this occurs, and the temperature of injected water increases, the casing pressure raises to a point of pressure release. Therefore, leaving the valve furnishing fresh water to the casing open all the time is not entirely desirable. Reasonable operating rules follow:

1. If casing pressure falls to 25 psi or lower repressure annulus up to approximately 50 psi.
2. If casing pressure reaches or exceeds 100 psi, bleed it back to about 50 psi.
3. If injection stops, flush tubing with fresh water for two hours unless injection is resumed.
4. After the well flushing is complete, be ready to bleed off casing pressure in an hour or three.
5. Check tubing pressure, casing pressure, volume meter, gauge reading at pier (SE end of Pond 3) and transfer pump (SW end of Pond 3) daily.

These facilities are checked daily by C. H. Hesser\* by phone or in person. Also, monthly volumes are recorded and operating performance noted. If an anomalous condition develops, he should be notified immediately on Extension 618 or 578-2501 in Atwood, Illinois.

  
C. Hesser

mh

Distribution: DLAllen  
HLTeel  
LRHays  
TJTadler  
RRKalmar  
EOBridges  
ODKinney

\* H. D. Wince, Extension 563 or  
Arthur 543-3183, effective  
September 1, 1971



## ENVIRONMENTAL PROTECTION AGENCY

August 4, 1970

SPRINGFIELD, ILLINOIS 62706  
AREA 217 - 525-6580

U. S. INDUSTRIAL CHEMICALS COMPANY - Industrial Waste Disposal  
Deep Well Waste Injection Facility

PERMIT #1970-EA-517

U. S. Industrial Chemicals Co.  
P. O. Box 218  
Tuscola, Illinois 61953

Attention: Mr. Harley L. Teel  
Chief Engineer

*H. C. 504*

Permit is hereby granted to the U. S. Industrial Chemicals Company, P.O. Box 218, Tuscola, Illinois, to install and operate a deep well injection facility including all necessary surface works, for the disposal of acid waste gypsum water industrial wastes at their Tuscola plant located in Douglas County, Illinois, (injection well location is 430 feet south from the north line and 1135 feet east from the west line of the N. W. Section 31, Township 16N, Range 8E, Douglas County, Illinois), said industrial wastes to be injected into the Eminence-Potosi dolomite and Franconia formations, the injection zone between depths 5000 and 5507 feet below ground surface elevation of 693 above sea level, all in accordance with plans and specifications prepared by Mr. C. H. Hesser, project engineer (Registered Professional Engineer #16476 in the State of Texas), said plan documents consisting of the following: (1). Engineering Report, Proposed Disposal of Industrial Wastes Underground Through a Disposal Well by U. S. Industrial Chemicals Company, Douglas County, Illinois, dated November 18, 1969 and received December 2, 1969; (2). Plans-Procedures-Specifications for Underground Disposal System, U. S. Industrial Chemicals Co. #1, Tuscola, Illinois, as received January 7, 1970; (3). Application for Permit to Install and Operate, dated January 19, 1970 and received January 20, 1970; (4). U. S. Industrial Chemicals Co., Disposal Well No. 1, Tuscola, Illinois, - Well History, - dated May 27, 1970 and received June 2, 1970, including: (a) Drawing No. E 25P-5757 - New 4-inch Disposal Line from No. 3 Acid Pit to Well No. 1; (b) Drawing No. E 25F - 5760 - Well Configuration, U.S.I. Disposal Well No. 1; (c) Composite Well Log by R. F. Anderson, Consulting Geologist; (d) 3-D Bond Log (Birdwell) witnessed by Mr. C. H. Hesser; (5). Letter from H. L. Teel, Chief Engineer, U.S. Industrial Chemicals Co. to Environmental Protection Agency, dated July 13, 1970 and received July 15, 1970; being made a part hereof.

This permit is issued subject to the standard conditions set forth on Page 2, attached hereto and incorporated herein by reference.

Approval Subject to Special Conditions on Page 3, attached hereto.

This permit is granted in accordance with the provisions of the "Environmental Protection Act", approved June 29, 1970, and is subject to the following conditions:

1. If any statement or representation in the application is found to be incorrect, this permit may be revoked and the permittee thereupon waives all rights thereunder.

2. There shall be no deviations from the approved plans and specifications unless revised plans and specifications shall first have been submitted to the Environmental Protection Agency and a supplemental written permit issued therefor.

3. During or after the construction or the installation of the sewage works, any agent duly authorized by the Environmental Protection Agency shall have the right and authority to inspect such work and its operation.

4. This authority: (a) shall not be considered as in any manner affecting the title to the premises upon which the sewage works are to be located, (b) does not release the permittee from any liability for damage to person or property caused by or resulting from the installation, maintenance or operation of the proposed sewage works, (c) does not take into consideration the structural stability of any units or parts of the project, and (d) does not release the permittee from compliance with stream channel requirements of the State Division of Waterways, with other applicable statutes of the State Division of Waterways, with other applicable statutes of the State of Illinois, or with applicable local laws, regulations or ordinances.

5. This permit is void one year from date of issue unless installation of this project has started on or prior to date of expiration.

6. Rain water from roofs, streets and other areas, and ground water from foundation drains shall be excluded from the sewer system.

7. The installation shall be made under the supervision of an inspector provided by or approved by the operating agency.

8. Treatment works will be operated or supervised by a duly qualified sewage works operator Certified under the Regulations of the Environmental Protection Agency.

Special Condition: This permit is granted on the basis that:

- (a) Monthly Operation Reports be submitted to this Agency, including data (for each day's operation) on rates and volume of wastes injected, characteristics of wastes, injection pressures, annulus pressures, and any information indicative of changes in the operation of the deep well injection facility.
- (b) Injection pressures at the well head be limited so as not to produce bottom hole pressures in excess of 0.65<sup>psi</sup> per square inch per foot of hole depth including the static column pressure of the industrial waste fluid to be injected, which injection pressure limit is computed to be 1104<sup>psi</sup> per square inch at the ground surface for 5500 depth hole, fluid specific gravity of 1.034 and static water level of 180 feet.
- (c) Injection pump specifications and performance curves must be submitted to this Agency for approval prior to the installation of any pump to be used in surface transfer piping connected to the well head.
- (d) Volume rate versus well head pressure curves be developed and submitted to this Agency for the injection well following the installation of the 4-inch diameter injection string proposed to replace the 2½ inch diameter injection string and also observation of the static water level.
- (e) There is to be no injection of industrial wastes with characteristics other than those set forth in the above listed plan documents made a part of this permit prior to obtaining the approval of this Agency.

C. W. Klassen

C. W. Klassen

Director

Environmental Protection Agency

cc: -East Central Region  
-C. H. Hesser, Engineer  
-Illinois Geological Survey  
-Illinois Water Survey  
-Illinois Dept. of Mines & Minerals

WLA:js

ATTACHMENT 3

PLANS, PROCEDURES AND SPECIFICATIONS

FOR

A SYSTEM OF DISPOSAL OF  
INDUSTRIAL WASTES UNDERGROUND

BY

U. S. INDUSTRIAL CHEMICALS COMPANY

TUSCOLA, ILLINOIS

Prepared by:

C. H. HESSER

Professional Engineer

Texas Registration No. 16476

January 2, 1969

### Introduction

A thorough investigation and evaluation of all factors and methods indicate an overwhelming advantage for underground disposal of gypsum waste water at U. S. Industrial Chemicals Company's Tuscola, Illinois Plant. (See Engineering Report dated November 18, 1969, by C. H. Hesser, for more background.) The proposed well is located near the southwest corner of Waste Water Pit No. 3 into which all the gypsum waste water pits drain. The specific well location is 430 feet from the north line and 1035 feet from the west line of the NW Section 31, Township 16N, Range 8E, Douglas County, Illinois.

### Geological Considerations

The proposed well is located on the west flank of the Tuscola Anticline, a part of the LaSalle anticlinal belt in the Illinois Basin. The regional dip of the basin is south, but the beds at the well dip southwest due to the influence of the Tuscola Anticline. It is expected

Geological Considerations continued

that the 13-3/8" conductor pipe will be set in the upper Pennsylvanian, the 9-5/8" surface pipe in the Silurian below which no fresh water is present, and the 7" production pipe in the base of the Prairie du Chien formation. This should provide an impermeable cap rock of approximately 900 feet thickness from the casing setting point up to the St. Peter sandstone. Above the St. Peter there is additional impermeable rock in the Galena-Platteville and Maquoketa formations.

The proposed disposal zone is the Eminence-Potosi dolomite which is expected to be vuggy and fractured at the well location. There are no known oil, gas, coal or other commercial minerals present in this zone in this immediate area. Drill cutting samples will be caught on 10-ft. intervals and a geologic cross section and the samples made available to the Illinois Sanitary Water Board and Geological Survey. The predictable geologic conditions should be quite accurate since another well exists nearby.

Well Configuration (See sketch at back of this report)

The proposed well will be drilled with rotary tools.

It will be spudded and drilled with a 17-1/4" bit to 200 feet. A string of 13-3/8", 48-lb., H-40, Range 3, STC, new casing will then be run and cemented back to the surface using 175 sacks of cement. The casing will be centered in the hole with two centralizers. Also, a guide shoe and float valve will be a part of the casing string. The cement will have 3 per cent calcium chloride added to hasten hardening and increase the strength. The volume of cement is 50 per cent greater than the drilled volume to insure that sufficient cement is available to fill any washed-out portions of the hole.

After nipping up the 13-3/8" flange of the Christmas tree, a blowout preventer will be installed and a 12-1/4" diameter hole will be drilled to a porous zone 2800 to 3000 feet where a drill stem test will be taken and water samples swabbed from the hole and tested by the Illinois Sanitary Board representative to determine salinity (or freshness). Sufficient notification will be given to permit the aforementioned representative to arrive at

Well Configuration continued

the drill site prior to the test. After reaching a depth below the fresh water limit (10,000 ppm), an electrical log consisting of Self-Potential and Induction log curves will be run and copies furnished as required. Then 9-5/8", 36-lb., H-40, STC, Range 3, new casing will be run using 15 centralizers and cemented back to the surface with 1000 sacks 50-50 Pozmix cement with 5 per cent salt added. Both float collar and float shoe will be used on this casing string.

After nipping up on the 9-5/8" casing, the hole will be drilled to 5000 feet with an 8-3/4" diameter bit. The same type electrical log will be run on the new hole. New 7" casing, 20 and 23-lb., J-55, STC, Range 3 will be run and cemented with 850 sacks of cement and 1/2 of 1% CFR-2 followed by 50 sacks of Halliburton "densified" cement to provide maximum security around the casing shoe. Both float collar and float shoe will be used, plus 20 centralizers. The bottom joint of 7" casing will be sandblasted and epoxy-coated with plastic on the inside on the bottom 10 feet.

Well Configuration continued

After nipping up on the 7" casing, hole will be drilled until lost circulation in the Eminence-Potosi formation is reached. A sample of the formation water will be taken and salinity measured. A cement bond log will be run to analyze and evaluate the cement job behind the 7" casing and remedial squeeze jobs performed as necessary to insure no vertical communication could ever exist between the casing and formation.

The well will be completed by running plastic-coated 2-1/2" tubing with retrievable packer (coated with plastic inside and out) set near bottom of the 7" casing at 5000 ft. A 30-ft. stinger joint will extend below the packer and oil spotted to occupy the annulus from the end of the stinger back up to the packer. The stinger will be material of Carpenter 20, a superior grade of stainless steel which will not corrode in the gypsum waste water.

The Christmas tree will be internally plastic-coated. Permanent continuous recording pressure gauges will be

Well Configuration continued

installed on the tubing and tubing-casing annulus. The tubing-casing annulus will be full of fresh water (corrosion inhibitor added) and pressured to approximately 90 psi. Therefore, the pressure monitor on the tubing-casing annulus will immediately alert the existence of a leak, if it should occur.

Surface Facilities

The waste gypsum water will be transferred from Pit No. 3 to the well site through 4-inch diameter plastic pipe. A continuous recording volume meter will measure all liquid injected. The final selection of a surface pump must necessarily be deferred until injectivity tests are made at the completion of the well. It is probable that no pump will be needed and the injection can be made under vacuum. In any case, a valve will be included in order that the injection rate can be controlled. Upon completion, a final sketch of both the well and surface facilities will be submitted for the record.

### Records

In addition to the geologic section, samples, electric logs, and sketches previously mentioned, a daily record of annulus pressure, tubing pressure, and volume injected will be kept and the latter submitted to the Illinois Sanitary Water Board monthly, along with the cumulative total.

### Operations

In approximately two years, it is expected that the present process which produces waste gypsum water will be closed. It is desirable to continue to use part of the waste water until then, but the present volume of approximately 130,000,000 gallons will be reduced so that only a small volume will remain for disposal at the end of two years. The initial injection rate for disposal will depend on the injectivity capacity of the well, but it is planned to inject 200 gpm or more until the total pit volume has been reduced to a more comfortable magnitude. After the waste gypsum water is all disposed underground, several hundred barrels of

Operations continued

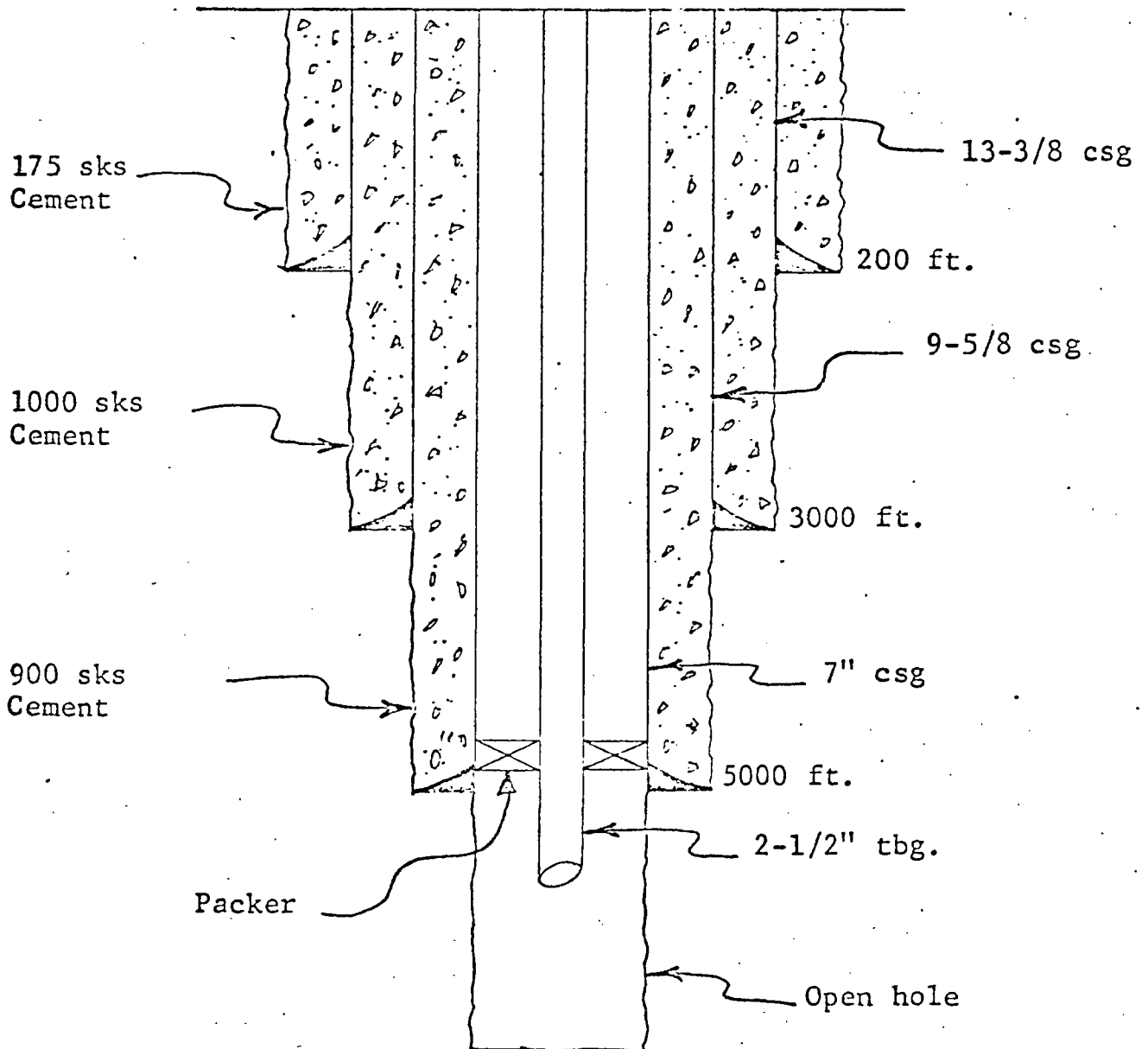
fresh water will be injected to displace the waste water out of the well into the formation and establish a non-corrosive environment in the well bore. (Volume of tubing and hole below packer is 45 barrels). The well will then be shut in, pending the development of other possible liquid wastes for underground disposal or permanently plugged and abandoned. Any new liquids would probably be of relatively small volume, but applications would be prepared and submitted to the Illinois Sanitary Water Board, if their disposal were merited underground.

Permanent Abandonment

When the well is no longer needed, a plan for permanent plugging will be submitted to the Illinois Sanitary Water Board for approval before proceeding with the work. One possible plan would be to pull tubing, fill the entire hole with cement, remove the Christmas tree and install a permanent marker on top of the well.

WELL CONFIGURATION

USI Chemicals No.1



**U.S. INDUSTRIAL CHEMICALS CO.**

Division of National Distillers and Chemical Corporation • P.O. Box 218, Tuscola, Illinois 61953 • (217) 253-3311

ATTACHMENT 4

May 27, 1970

2598-73  
RECEIVED

Mr. Clarence W. Klassen  
Technical Secretary  
State Sanitary Water Board  
Springfield, Illinois 62706

MAY 27 1970  
ENVIRONMENTAL PROTECTION AGENCY  
STATE OF ILLINOIS

Dear Sir:

Attached is a history of development data on USI Chemicals Company's disposal well, together with a composite well log, a well configuration drawing and a plat showing surface facilities.

From these data it will be noted that the original plan as submitted to your office has been followed. Additions were made with verbal approval from your office to acidize and perforate the open hole below casing to improve injectivity at lower pressures.

We are confident of this well being a safe disposal well and, therefore, respectfully request a permit for injection of gypsum waste water.

Yours truly,

Harley L. Teel  
Chief Engineer

CHH/hw



WELL HISTORY - USI DISPOSAL WELL NO. 1

Location: 430 Ft. south and 1135 Ft. east of the northwest corner of Section 31, Twp. 16N - Range 8E, Douglas County, Illinois.

Contractor: R. H. Troop Drilling Company  
St. Elmo, Illinois

Elevation: Ground - 693 feet above sea level.

Rotary bushing - 708 feet above sea level.

NOTE: All measurements are from rotary bushing.

Time of Drilling: Drilling commenced at 11:00 a.m. on April 7, 1970 and ended at total depth of 5524 feet at 5:00 a.m. on May 9, 1970.

Casing Program: New 13-3/8" casing was set at 219 feet with 200 sacks of Class "A" cement, plus 3 per cent calcium chloride. A guide shoe was used, plus insert float one joint (40 ft.) off bottom. Centralizers were placed 40 feet and 120 feet from bottom.

Casing Program: New 9-5/8" casing was set at 2810 feet with  
(Continued)  
700 sacks Howco "lite" cement (yield 1.56 cu. ft./sack), followed by 100 sacks Class "A" cement (yield 1.18 cu. ft./sack), plus 2% calcium chloride. Therefore, 38% excess volume was used to insure circulation of the cement to surface. A float shoe was used, plus a float collar one joint off bottom. Centralizers were placed every third joint (90 feet apart).

New 7" casing was set at 5015 feet with 750 sacks of cement, plus 15% salt and 3/4 of 1% CFR-2, followed by 100 sacks of Class "A" cement, plus 15% salt and 1% CFR-2 to get densified cement around the shoe and provide over 50% excess volume of cement throughout the open hole portion of the well. A DV cementing tool was used at 4356 feet. Centralizers were used on 90-ft. spacing. A bond log was run from total depth back up past the 9-5/8" casing point. A good cement job is indicated from the log.

Size of Hole: A 17½" bit was used to 225 feet, a 12½" bit was used to 2811 feet, an 8-3/4" bit was used to 5019 feet, and a 6½" bit was used to the total depth of 5524 feet.

Hole Deviation:	<u>Depth - Feet</u>	<u>Declination</u>
	220	0
	1680	3/4°
	2810	1/2°
	2900	1/2°
	4238	1/2°
	5000	3/4°

Salinity Test: A drill stem test of the Silurian formation from 2412 to 2510 feet was made and water samples collected which showed a salinity greater than 10,000 ppm. The intermediate casing was set 300 feet deeper to further insure safe protection of fresh water zones.

Tubing: The tubing used is 2.875" OD, EUE, J-55, with a baked-on plastic liner inside. Tubing is landed at 4990 feet on a Halliburton R-4 packer.

Logs: Induction - Laterolog - Self-potential logs were run on all except the surface hole to 210 feet.

The open hole below 7" casing was logged with the bond log to find possible zones which would accept injection of fluids. It is indicated that weak zones exist from 5020 to 5030 feet, from 5144 to 5176 feet, and from 5186 to 5194 feet, respectively. This provides a minimum of 50 feet thickness for injection. The bond log was run back up past the 9-5/8" intermediate string setting point to check the cement job on the 7" production string of casing.

The geological tops and other pertinent well information have been added to the well log prints to enhance their worth in reviewing the well.

Injectivity Tests: The following injection tests were run before acidizing.

<u>Surface Pressure</u>	<u>GPM Injected</u>
120 psi	98
200 psi	136
525 psi	200
675 psi	243

Injectivity Tests: After acidizing with 10,000 gallons of  
(Continued)

HCL, the injection rates were:

<u>Surface Pressure</u>	<u>GPM Injected</u>
300 psi	150
500 psi	220

Drill Cuttings: Samples were collected and furnished to the  
U. S. Geological Survey in Urbana, Illinois.

Static Bottom Hole Pressure: The static liquid level was  
measured at 175 feet below the  
rotary bushing before the well  
was acidized and afterward was  
found at 180 feet on two sepa-  
rate measurements. Therefore,  
at 5500 feet depth, the static  
bottom hole is:

(5500-180) times .434 (H<sub>2</sub>O grad.)  
or 2309 psi.

Corrosion Protection: The tubing and Xmas tree are plastic-coated, the tubing stinger below the packer is plastic-coated both inside and outside, the packer is coated both inside and outside with plastic.

The annulus between the 2½" tubing and 7" casing is filled with fresh water slightly alkaline and treated with two barrels of Coretron (no chromium present).

Lease crude was spotted below the stinger and allowed to float up, filling the hole below the packer down to the bottom of the stinger. Thus, the bottom of the casing, packer and tubing is protected by oil to prevent corrosion.

Well Stimulation: The open hole was acidized with 10,000 gallons of HCL through the tubing.

The open hole was perforated from 5144 to

Well Stimulation: 5176 feet and from 5186 to 5194 feet with  
(Continued) three jet shots/ft.

Estimated Size of  
Injection Puddle:

The present gypsum ponds have approxi-

mately 140,000,000 gallons of waste

water. However, by the time it can be

emptied, it is estimated that rainfall

will add another 10,000,000 gallons over

evaporation rate. Therefore, assuming

150,000,000 gallons and a thickness of

50 feet with porosity of 25 per cent -

150,000,000 gallons equal 20,000,000 cu. ft.

Then radius squared x Pi x porosity x thick-

ness equals 20 million cubic feet.

Or radius squared x 3.1416 x .25 x 50

equals 20 million.

Or radius squared equals  $\frac{20,000,000}{3.1416 \times .25 \times 50}$

Radius squared equals 509,294.

Estimated Size of  
Injection Puddle: Then radius equals 713 feet.  
(Continued)

It is probable that some water will enter other zones besides the zones of weakness previously mentioned and the actual puddle will probably be even smaller than 700 feet in radius.

A handwritten signature in cursive script, reading "C. H. Hesser". The signature is written in dark ink and is positioned above the typed name.

C. H. Hesser  
Project Engineer

CHH/hw

5/27/70

**U.S. INDUSTRIAL CHEMICALS CO.**

Division of National Distillers and Chemical Corporation • P.O. Box 218, Tuscola, Illinois 61953 • (217) 253-3311

ATTACHMENT 4

May 27, 1970

2598-73

Mr. Clarence W. Klassen  
Technical Secretary  
State Sanitary Water Board  
Springfield, Illinois 62706

Dear Sir:

Attached is a history of development data on USI Chemicals Company's disposal well, together with a composite well log, a well configuration drawing and a plat showing surface facilities.

From these data it will be noted that the original plan as submitted to your office has been followed. Additions were made with verbal approval from your office to acidize and perforate the open hole below casing to improve injectivity at lower pressures.

We are confident of this well being a safe disposal well and, therefore, respectfully request a permit for injection of gypsum waste water.

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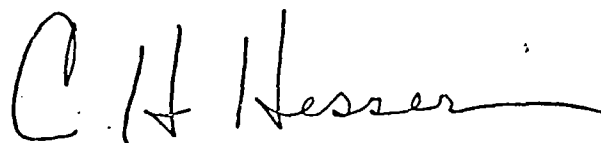
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